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METHODS AND SYSTEMS FOR AUTOMATICALLY AND ACCURATELY GENERATING CALL DETAIL RECORDS FOR CALLS ASSOCIATED WITH PORTED SUBSCRIBERS

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Description

METHODS AND SYSTEMS FOR AUTOMATICALLY AND ACCURATELY GENERATING CALL DETAIL RECORDS FOR CALLS ASSOCIATED WITH PORTED SUBSCRIBERS

Related Applications

This application claims the benefit of U.S. provisional patent application no. 60/450,725, filed February 27, 2003, the disclosure of which is incorporated herein by reference in its entirety.

Technical Field

The present invention includes methods and systems for generating call detail records (CDRs). More particularly, the present invention relates to methods and systems for automatically and accurately generating CDRs for calls associated with ported subscribers.

Related Art

In the past, monitoring systems have been deployed in telecommunications networks to produce call detail record (CDR) information,

which may in turn be used to support applications such as billing, billing verification, fraud detection, etc. A significant shortcoming with these systems involves the fact that within the telecommunications industry it is possible that number portability translation may occur at any point along the signaling pathway. While current industry standards recommend that number portability (NP) translation service should occur either prior to, or upon a signaling message reaching the "n-1" network (that is, the network that the signaling message traverses just prior to reaching the target or terminating network), this recommendation is not always followed by the collection of network operators that form a telecommunications network.

Consequently, in an NP environment, (wireline or wireless) systems that capture data and ultimately produce a CDR from signaling messages in the SS7 network can become limited in the information they produce depending on whether the called/calling party numbers lie within an NPA-NXX that has become portable. The limitations can become severe enough to reduce the value of existing data-mining-like reporting systems and/or necessitate that downstream systems, such as billing systems, obtain the necessary NP information by alternative arduous and costly means. That is, in a number portability environment, precisely where a call is monitored becomes a major factor with regard to the information that can be extracted or provided from the resultant CDR to a downstream system. More specifically, if a CDR is extracted prior to translation, the resultant CDR will only contain the dialed number and

optionally the calling party number. As such, any subsequent processing may yield erroneous results if the dialed number has actually been ported to another service provider. Further, if the calling party number is itself a ported number, jurisdiction (geographical, rating, etc.) may also be misreported in any subsequent processing.

Figure 1 illustrates a monitoring scenario in an SS7 signaling network involving a call from a first subscriber to a second subscriber, where the second subscriber has been ported. In Figure 1, a telecommunications network includes a first end office **100** associated with the calling party, a second end office **102** from which the called party number 360-481-1234 has been ported, and a third end office **104** to which the called party number has been ported. The telecommunications network may also include a number portability database **106** for storing routing numbers for ported numbers and a monitoring system **108** for monitoring call signaling messages and generating call detail records (CDRs). As illustrated in Figure 1, if a network monitoring system **108** generates a CDR **110** based on data collected at monitor point A or any other point prior to the NP translation, the collected information would lead one to believe that the call destination was the 360-481 exchange. As such, any reports or billing records based on CDR **110** generated from data collected at monitor point A would be in error and have to be corrected by a downstream process.

If monitoring system **108** were to generate CDR **112** based on data collected at monitor point B, any ensuing reports or billing records based on CDR **112** will correctly reflect the actual call destination. However, if, as illustrated in Figure 1, CDR **112** does not contain a jurisdiction information parameter (JIP), the actual point of call origination cannot be determined unless a local exchange routing guide (LERG) lookup is performed. Even if a LERG lookup is performed, this may not yield the originating switch if the call was from a ported number.

Because network monitoring systems may be limited in the locations where they can access signaling messages, CDR information may be incomplete or incorrect, as described above. For example, as illustrated in Figure 1, if a CDR is collected at monitor point A, the CDR may lack the LRN associated with the exchange to which the called party number has been ported. Similarly, if a CDR is created based on data at monitor point B, the CDR may lack information corresponding to the correct originating exchange if the calling party number has been ported. Thus, limited network access can cause conventional network monitoring systems to produce erroneous or incomplete CDRs.

Those skilled in the art of number portability in an SS7 signaling network environment will appreciate that, following a number portability translation, the original called party dialed digits are typically moved within the ISDN user part (ISUP) call setup message from the called party address parameter to the

generic address parameter (GAP), and a location routing number (LRN) associated with the terminating ported-to end office exchange is stored in the called party address parameter. Unlike the called party number methodology, the calling party number and the JIP are not transposed when the CgPN is ported. Rather, the originating switch should include JIP parameter with contents that are usually the NPA-NXX of the LRN associated with the originating switch along with the ported number in the CgPN parameter. However, in practice, this is not always done.

While some existing network monitoring systems may be capable of detecting whether a particular called party number or calling party number belongs to an NPA-NXX that is "portable," i.e., contains at least one NPA-NXX-XXXX that is or was ported, these systems cannot identify whether the actual number itself has been ported. As a result, these existing network monitoring systems are incapable of producing accurate CDRs when the called and/or calling party number has been ported.

U.S. patent application publication number US 2003/0002639 to Huie (hereinafter, "Huie") discloses a real time call validation system in which an originating carrier switch sends a special billability message to a central control server to determine billing relationships between carriers for collect and bill-to-third-party calls. The central control server then determines whether the dialed number has been ported by sending a TCAP query to an LNP database. If the called party dialed digits do not match the digits in the query response, the

central control server determines that the called number has been ported. If the called number has been ported, the central control server sets an indicator in the response message to the originating carrier so that the carrier can determine whether to allow the call to be completed. Huie also discloses that "the carrier may insert an indicator or flag in the call detail record to indicate to the carrier's own billing program or that of its clearing house that the call needs to be invoiced to a carrier different from the carrier to which the dialed number's NPA-NXX belongs."

While Huie discloses using number portability information to determine how to properly bill for a call, the methods and systems disclosed therein for obtaining and using the number portability information are undesirable for a number of reasons. First, Huie requires that the originating switch initiate a special billability message to the central control server in order to obtain number portability information. Since call processing is suspended during the time that the originating switch waits for a response to the billability message, call setup time is increased. Second, Huie discloses that a query to the number portability database is required to determine whether the number has been ported. This means that some queries to the number portability database will occur for calls to non-ported numbers, which unnecessarily increases network traffic, increases the processing load on the node managing the number portability database, and further increases call setup time.

U.S. Patent No. 5,699,416 to Atkins (hereinafter, "Atkins") discloses a system for querying an LNP database to obtain the correct line identification database for validation of an operator-assisted call billed to a ported directory number. Atkins, like Huie, requires suspension of call processing while number portability processing performed. In addition, Atkins states that the query to the number portability database is performed if a calling card is directory-number-based without regard to whether the particular directory number has been ported. These shortcomings of Atkins unnecessarily increase call setup time, signaling message traffic in the network, and the load on the number portability database.

Another fundamental shortcoming of the systems disclosed in Huie and Atkins is that both are narrowly tailored to billing validation systems. In Huie, the central call control server of the billing validation system performs the number portability database queries to determine whether or not to connect calls. In Atkins, the OSS performs the number portability database queries to determine whether which line information database to use to validate the calls. Performing number portability verification at a single special-purpose end system, such as a billing system, is inefficient because each end system that requires the information is required to perform its own number portability correction. This is inefficient and further increases the load on number portability databases.

Accordingly, there exists a need for improved methods and systems for automatically and accurately creating CDRs when the called and/or calling party number has been ported.

Disclosure of Invention

A number portability reconciliation (NPR) monitoring system of the present invention addresses industry-wide monitoring and billing problems by automatically querying an NP database for messages relating to calls to ported numbers using a number portability reconciliation monitoring system. In a preferred embodiment, the NPR monitoring system utilizes a TCP/IP connection between the monitoring system and a network NP database. Querying of the NP database may be accomplished using structured query language (SQL) or another functionally similar database access protocol. In an alternate implementation, the NPR monitoring system may utilize the SS7 transaction capabilities application part (TCAP) query and response protocol. The NPR monitoring system passively copies signaling messages relating to a plurality of different calls or transactions. By passively copying, it is meant that the NPR monitoring system copies signaling messages without otherwise affecting the progress of the call or transaction. The original signaling messages are allowed to proceed to their destinations. As a result, unlike the conventional systems described above, the present invention preferably does not delay call setup in performing number portability processing.

The NPR monitoring system correlates signaling messages that relate to the same call or transaction to produce a CDR including a superset of the message parameters required by downstream applications. The NPR monitoring system determines whether the call is directed to or from a ported directory number and queries the network number portability database using information contained in the CDR. The NPR monitoring system then incorporates information returned from the number portability database into the CDR. Because the CDR is updated based on a query to the number portability database, accuracy of the CDR is improved. In addition, because signaling messages are passively copied without requiring specialized billing validation queries, call processing is not adversely affected. Finally, because the CDR is a generic CDR containing a superset of parameters required by a plurality of different downstream applications, a single NP query can be used to generate an accurate CDR for many different applications.

Accordingly, it is an object of the invention to provide methods and systems for creating accurate CDRs when the called and/or calling party number has been ported.

It is another object of the invention to limit queries to number portability database for CDRs relating to calls in which the calling or called party number has been ported.

It is yet another object of the invention to produce a number-portability-corrected CDR usable by a plurality of different downstream applications, even

when the network monitoring system may have limited or no access to the network in which a number portability query is performed for a call.

Some of the objects of the invention having been stated hereinabove, and which are addressed in whole or in part by the present invention, other objects will become evident as the description proceeds when taken in connection with the accompanying drawings as best described hereinbelow.

Brief Description of the Drawings

Preferred embodiments of the invention will now be described with reference to the accompanying drawings of which:

Figure 1 is a network diagram illustrating an erroneous CDR created by conventional network monitoring systems;

Figure 2 is a network diagram illustrating a number portability reconciliation monitoring system according to an embodiment of the present invention;

Figure 3 is a flow chart illustrating exemplary processing that may be performed by a number portability reconciliation monitoring system according to an embodiment of the present invention;

Figure 4 is a network diagram illustrating an exemplary system architecture for a number portability reconciliation monitoring system according to an embodiment of the present invention; and

Figure 5 is a network diagram illustrating a probeless network monitoring system architecture suitable for use with a number portability reconciliation monitoring system according to an embodiment of the present invention.

Detailed Description of the Invention

An NPR monitoring system of the present invention may include or have access to information that identifies the NPA-NXX exchanges that serve ported subscribers. As such, only those signaling messages associated with calls to or from a subscriber in a ported exchange may trigger an NP database query by the NPR monitoring system. Thus, rather than querying the number portability database for all calls, the present invention preferably only queries the number portability database for calls associated with a ported exchange. By selectively querying the number portability database for numbers associated with ported subscribers, the present invention reduces unnecessary signaling and hits to the number portability database.

Furthermore, an NPR monitoring system may be configured to perform an NP database query in response to receiving certain types of call signaling messages. For example, an NP database query may be automatically triggered in response to receiving an ISDN user part (ISUP) initial address message (IAM) associated with a particular call, but not in response to receiving any subsequent signaling messages associated with the same call. As such, an NPR monitoring system of the present invention may perform a single NP

database query for each CDR produced. Because the query may be performed automatically in response to receiving a particular call setup message, the need for specialized queries to initiate number portability processing is reduced.

In one exemplary implementation, the number portability database query may be performed after receiving one message to be included in a CDR, such as the IAM message, but prior to receiving all of the messages to be included in the CDR. In an alternate implementation, the NP database query may be performed after receiving all of the messages to be included in the CDR.

An NPR monitoring system of the present invention may examine information contained within a received call signaling message that indicates whether a number portability translation is required or has already been performed. For example, an ISUP IAM message contains a 2-byte parameter known as the forward call indicator (FCI). The FCI parameter includes many 1- or 2-bit indicators that are designated by alphanumeric characters. For example, the m bit of the FCI parameter indicates whether or not a number portability translation has been performed. In the event that a received ISUP IAM message includes a ported CdPN and an FCI m bit value of zero indicating that a number portability database lookup has not already been performed, the NPR monitoring system may query an NP database in order to determine the LRN of the end office serving the ported called party. If, however, the FCI m bit indicates that a number portability database query has already been performed, the NPR monitoring system of the present invention preferably does not query

the number portability database, thereby further reducing unnecessary signaling and hits to the number portability database. In addition, in networks where non-standard number portability indicators are used to determine whether number portability lookup has been performed, the NPR monitoring system may analyze these parameters to determine whether to perform the NP database lookup. Examples of non-standard number portability status indicators that may be used to indicate whether a number portability lookup has been performed include the nature of address (NOA) parameter and the number portability forward information (NPFI) parameter. Using any parameter used by a network operator to determine whether a number portability database lookup has already been performed is intended to be within the scope of the invention.

If the NP database contains service provider identifier (SPID) information, the SPID associated with the ported called and/or calling party may also be obtained by the NPR monitoring system during the NP database query. The NPR monitoring system may incorporate the LRN and/or SPID information into a CDR associated with the call.

In the case of a call involving a ported calling party, as mentioned briefly above, an originating switch should, but does not always include a JIP parameter with contents that are usually the NPA-NXX of the LRN associated with the originating switch in one of the call setup messages. If no JIP parameter is specified by the originating switch, an NPR monitoring system of the present invention may determine the appropriate NPA-NXX of the LRN

associated with the originating switch by querying the number portability database using the calling party number and incorporate this value into a JIP parameter associated with the CDR.

As such, an NPR monitoring system of the present invention may provide network operators with a means to correctly identify the origination and termination of calls placed within and through their networks, enable billing records to be created that are complete (i.e., that include the required number portability elements), and monitor and report on NP activity. Furthermore, because the NPR monitoring system performs NP database queries, it no longer matters where the data used to create the CDR is captured, as the NPR system can look up any necessary information that may be missing.

An NPR monitoring system of the present invention may also be used in network environments that employ signaling protocols other than or in addition to SS7. For example, Internet protocol (IP) telecommunication services may employ session initiation protocol (SIP), H.323 protocols (e.g., H.225, H.245, etc.) for call signaling operations. These signaling protocols, and consequently their associated number portability databases may utilize different called and calling party identifier formats other than conventional 10-digit telephone numbers. For example, in IP telephony environments, callers may be identified by electronic mail addresses, uniform resource locators, etc. However, the basic principles of NPR monitoring system operation apply to networks that utilize such signaling protocols. That is, a sequence of related signaling

messages is captured, a call detail record is produced, a subscriber portability database is queried, and the returned service portability information is incorporated within the call detail record. The call detail record may be specific to a particular signaling protocol or independent of the type of signaling protocol used to establish the call or conduct the transaction. The corrected call detail record may then be provided to downstream applications, such as billing applications, billing verification applications, fraud detection applications, quality of service applications, etc.

By querying a number portability database if a CDR includes called or called party numbers that have been ported, the present invention allows network monitoring to be performed accurately from a single location in the network. The single location in the network can be a particular leg of a call before a number portability translation has been performed. The network monitoring may be performed at any location at which call setup messages can be captured, even including locations upstream from the network where a number portability database lookup occurs for a call. Thus, the present invention allows accurate CDRs to be created, even when there is no access to the service provider's network in which a number portability database lookup is performed.

Figure 2 is a network diagram illustrating a network including an NPR monitoring system according to an embodiment of the present invention. Referring to Figure 2, the network includes calling party end office **100**, end

office **102** from which the called party number 360-481-1234 has been ported, end office **104** to which the called party number has been ported, and number portability database **106**. Number portability database **106** may be a local number portability database containing number portability information for wireline subscribers, a mobile number portability database containing number portability information for mobile subscribers, or a combined local/mobile number portability database containing number portability data for wireline and mobile subscribers. In addition, the network illustrated in Figure 2 includes NPR monitoring system **200** for reconciling number portability data according to an embodiment of the present invention.

In Figure 2, NPR monitoring system **200** may generate an accurate number portability corrected CDR **114**, regardless of whether NPR monitoring system **200** has access to CDR data at monitor point A or monitor B. For example, if NPR monitoring system receives CDR **110** generated by monitoring the network from monitor point A, NPR monitoring system **200** would query number portability database **106** to obtain the LRN corresponding to end office **104**. Similarly, if NPR monitoring system has access to CDR **112** at monitor point B, NPR monitoring system **112** may query number portability database **106** to determine the LRN corresponding to the end office from which the calling party number was ported. This information may likewise be incorporated into number portability corrected CDR **114**. Thus, using an NPR monitoring system

as illustrated in Figure 2, accurate CDRs can be created, even when the locations from which a network can be monitored to create CDRs are limited.

NPR CDR Processing

Figure 3 is a process flow diagram illustrating CDR generation and related NP processing by NPR monitoring system **200**. Referring to Figure 3, in step **300**, NPR monitoring system **200** receives signaling messages from different calls or transactions. In step **302**, NPR monitoring system **200** correlates signaling messages relating to the same call to form a CDR or a partial CDR. NPR monitoring system **200** may generate a raw CDR, which refers to an unformatted CDR. The CDR may include a superset of parameters required by a plurality of different downstream applications.

In step **304**, NPR monitoring system **200** determines whether the called party number in the CDR is associated with a portable exchange. If the exchange corresponding to the CdPN is determined to be portable, control proceeds to step **306** where the message may be examined to determine whether a number portability lookup has already been performed. This step may include examining the FCI m bit or non-standard number portability specifiers, such as the nature of address (NOA) indicator or the number portability forward information (NPFI) parameter. If the CdPN is in a portable exchange and an NP translation has not already been performed, control proceeds to step **308** where NPR monitoring system **200** queries NP database

106. If the number portability database lookup results in a hit indicating that CdPN is ported, control proceeds to step **310** where NPR monitoring system **200** incorporates the LRN and/or service provider identification (SPID) information returned by NP database **106** into the CDR. Once the number portability database results have been incorporated into the CDR, control proceeds to step **312** where the CDR is completed and put into a standardized format.

Returning to step **304**, if the called party number is not within a ported exchange, control proceeds to step **314** where the CDR is completed without a number portability lookup. Similarly, in step **306**, if a number portability lookup has already been performed, control proceeds to step **314** where the CDR is completed without performing a number portability lookup. Performing a number portability lookup only when necessary reduces the increase in traffic in the network caused by network monitoring. Such a reduction can be important in conserving bandwidth within a service provider's internal network.

Returning to step **302**, it may also be desirable to determine whether a calling party number has been ported and to correct the calling party number in a CDR if the calling party number has been ported. Accordingly, in step **316**, NPR monitoring system **200** determines whether the calling party number in the CDR being created is associated with a portable exchange. If the CDR is associated with a portable exchange, control proceeds to step **318** where NPR monitoring system determines whether the originating switch NPA-NXX is

stored in the JIP parameter in received call signaling messages. If the JIP parameter includes the NPA-NXX of the originating switch, then there is no need to query the number portability database because the originating switch for the call is known. However, if the JIP parameter is null or the originating switch does not use the JIP parameter to exclusively for calls originating from ported numbers, control proceeds to step **320** where NPR monitoring system **200** queries number portability database **106** based on the calling party number.

Once the LRN corresponding to the originating switch has been determined, control proceeds to steps **310** and **312** where the number portability database lookup results are incorporated in the CDR and the CDR is completed, as described above.

Returning to step **316**, if the calling party is not within a portable exchange, control proceeds to step **322** where the CDR is completed without performing a number portability lookup. Similarly, if the originating switch NPA-NXX is stored in the JIP parameter, control proceeds to step **320** where the CDR is completed without performing a number portability database lookup. Thus, steps **316**, **318**, and **322** conserve bandwidth in a service provider's internal network in a manner similar to steps **304**, **306**, and **314**.

Although the steps illustrated in Figure 1 suggest separate number portability database lookups for calling and called party numbers, the present invention is not limited to performing separate number portability database

lookups for calling and called party numbers. In a preferred embodiment of the invention, NPR monitoring system **200** may formulate a single number portability database query that requests routing numbers for both called and calling party numbers in the CDR. For example, if NPR monitoring system **200** determines that both the calling and called party numbers are within portable exchanges, the number portability lookup for the called party number has not been performed, and the originating switch NPA-NXX is not stored in the JIP, NPR monitoring system **200** may request the ported-from NPA-NXXs for both the called and calling party numbers in a single number portability database query. If a number portability lookup has already been performed for the called party number, the calling party number is within a portable exchange and the originating switch identifier is not stored in the JIP, NPR monitoring system **200** may formulate a number portability database query for the calling party number only. Similarly, if the called party number is within a portable exchange, a number portability lookup has not been performed for the called party number, and the calling party number is either not within a portable exchange or the originating end office identifier is stored in the JIP, NPR monitoring system **200** may formulate a number portability database query for the called party number only. Thus, by intelligently combining number portability queries for calling and called party numbers, an NPR monitoring system of the present invention further conserves bandwidth in a service provider's network. In addition,

number portability database resources are also conserved by limiting the number of number portability database queries.

In addition to obtaining routing numbers from a number portability database lookup, NPR monitoring system **200** may also obtain service provider identification information from the number portability database. This service provider identification information may be incorporated into CDRs and used to generate billing information.

Once NP related processing is complete, additional processing may be performed by an NPR monitoring system **200**. For example, CDRs produced by an NPR system may be provided as input to any number of network applications including usage measurements applications, billing applications, billing verification applications, fraud detection applications, usage measurement applications, etc.

NPR Monitoring System Architecture

Figures 4 and 5 illustrate exemplary NPR monitoring system architectures based on the Sentinel™ platform available from Tekelec of Calabasas, California. Figure 4 illustrates a generic NPR system architecture that collects signaling information from either discrete communication link probes or from an integrated signal transfer point/signaling gateway message copying interface. In Figure 4, a pair of site collectors **400** collect and temporarily buffer monitored signaling messages. Site collectors **400** may be

connected to external signaling link probes that passively copy signaling messages from SS7 signaling links or to network monitoring processors (NMPs) that receive and store signaling messages copied from signaling links within a routing node, such as an STP.

Each site collector **400** may be a general purpose computing platform including a microprocessor and one or more applications executing thereon. In the illustrated example, each site collector includes a filter application **402**, a data capture application **404**, and an MSU database **406**. Filter application **402** filters received signaling messages based on filter criteria received from a Sentinel™ server **408**. The filter criteria are preferably structured that the data captured by site collectors **400** is the superset of data required by billing application **410** and other business applications **412** and **414** resident on data gateway server **416**. That is, each site collector **400** may send a non-redundant stream of MSU data across Ethernet WAN **418** to data gateway server **416**. Sending a non-redundant stream of MSU data conserves bandwidth in service provider's internal network.

Data capture applications **404** capture raw MSU data copied by the link monitors or NMPs. MSU databases **406** store MSUs captured by data capture application **404** and filtered by filter application **402**.

Data gateway server **416** generates CDRs required by the various applications. In the illustrated example, data gateway server **416** includes NPR monitoring system **200** for performing number portability correction and

reconciliation of CDRs, as described above. NPR monitoring system **200** may be implemented in hardware, software, firmware, or any combination thereof.

As stated above, NPR monitoring system **200** on DGS **416** may query NP database **106** for called and/or calling party numbers within portable exchanges. The NP query may be transmitted to the NP database and a response may be received from the NP database via an Ethernet WAN **418** connection, as illustrated in Figure 4. Following NP correction of the CDR, DGS **416** formats and filters the CDRs (as necessary) and provides information to various associated network service applications, such as billing, billing verification, fraud detection, mass call detection, quality of service, etc. Because NPR monitoring system **200** creates a single number-portability-corrected CDR usable by a plurality of different downstream applications, the present invention provides increased versatility over current CDR generation systems, especially those that are narrowly tailored to work with billing validation systems.

Figure 5 is a block diagram illustrating a network monitoring system in which NPR monitoring system **200** may be incorporated in more detail. In Figure 5, site collector **400** is connected to network monitoring processors **500** which receive signaling messages copied from a routing node **502**. In the illustrated example, routing node **502** comprises a signaling transfer point with a plurality of link interface modules **504**, a data communications module **506**, and a network monitoring transport card **508**. Each module may include a printed

circuit board with an application processor and a communications processor mounted thereon. Modules **504**, **506**, and **508** are connected to each other via a counter rotating dual ring bus **510**. Link interface modules **504** send and receive SS7 signaling messages over SS7 signaling links and perform MTP3 routing functions. Link interface modules also include MSU copy functions **512** for copying SS7 signaling messages received over SS7 signaling links for network monitoring purposes. DCM **506** sends and receives signaling messages over IP signaling links. DCM **506** may also include a message copy function **514** copying signaling messages received over IP signaling links. For example, message copy function **514** may copy SS7 signaling messages sent over IP signaling links or IP telephony signaling messages sent over IP signaling links for network monitoring purposes.

Network monitoring transport card **508** communicates messages copied from signaling links to network monitoring processors **500**. When a message copy function **512** or **514** copies signaling messages from a signaling link, the message copy function broadcasts a service request to network monitoring processors **500** via network monitoring transport card **508**. In response to the service request, the network monitoring processor provisioned to service the particular copy function establishes a TCP/IP connection with the message copy function via network monitoring transport card **508**. The message copy function then sends copied MSUs to the network monitoring processor over the TCP/IP connection. Network monitoring processors **500** store signaling

message copies and forward the copies to site collector **400**. Site collector **400** filters the messages and transmits the messages to data gateway server **416** as described above. NPR monitoring system **200** generates number-portability-corrected CDRs by querying number portability database **106**.

Thus, the present invention is capable of producing accurate CDRs even when the called or calling party number has been ported. By querying the NP database before delivering the CDR to downstream systems, the present invention greatly increases the accuracy and efficiency of downstream system operation. Performing number portability correction for CDRs also allows network monitoring to be performed from a single location in the network, even before the location at which a number portability database query occurs. In addition, by producing a single number-portability-corrected CDR with parameters usable by multiple applications, the present invention provides increased versatility over conventional CDR generation systems. Finally, because the present invention preferably only queries the LNP database for numbers that are actually ported and for which a number portability translation has not already been performed, unnecessarily signaling is reduced.